STREAM RESTORATION

Using Bioengineering Techniques
"A Demonstration Project"
Rock Creek Park, City of Frederick

Throughout the years, streams in Maryland have been meandering and changing course by the process of erosion. Some of this erosion is natural from storm events, but some is manmade, triggered by increased runoff from developments, shopping centers, and even highways. As we add these impervious surfaces and reduce natural infiltration of rain and snowmelt, the watershed responds by increasing storm flow and water velocity in the streams. Commonly, streams widen and streambeds erode downward, generating sediment that creates further problems downstream.

Baughman's Lane, 2 years after construction

Streamside woody vegetation increases habitat diversity and filters runoff.

Traditionally, minimizing erosion of streambanks has been accomplished by structural means (e.g., loose stone rip rap on a 2:1 slope or stone-filled gabion baskets). Structures may be the only solution in some situations, but an alternative does exist using **"soil bioengineering"** technology—the use of trees, shrubs, and plants to create the desired outcome: stable streambanks and healthy streams. Often, some rock and coir fiber roll toe protection or other structural measures are used in combination with vegetative techniques to enable the practices to withstand the current hydrological regime and address problems like stream down-cutting. The streamside trees, shrubs and plants, once established, provide self-perpetuating erosion control; the branches slow water near the bank and roots bind soil. The diverse vegetation increases wildlife habitat, provides a natural attractive setting, and improves water quality—filtering out pollutants from runoff from adjacent areas and reducing sediment and nutrients in the stream.

Before
Eroding Stream Meander

After
Protected Stream Meander

Before
Eroding Bike Path

After
Protected Bike Path

PROJECT DESCRIPTION AT THE BAUGHMAN'S/BEL AIRE LANE PROJECT

PROBLEM

- Undermining of asphalt bike path
- Potential exposure of sewer lines
- Eroding streambanks
- Restricted fish passage
- Increased sedimentation and turbidity
- Loss of trees and other natural vegetation
- Erosion from stormwater drainages

BIOENGINEERING SOLUTIONS

- Upper streambank stabilization;
  - –Live stakes, coir fiber matting,
  - –Trees, shrubs, grasses
- Toe and Meander protection;
  - –Coir fiber roll, planted
  - –Stone (rip-rip, imbricated)
- Fish Habitat Enhancement;
  - –Rock cross vanes to improve fish passage, pools
  - –Shade from planted trees
- Stormwater/overflow channels;
  - –Live stakes, coir fiber matting, shrubs, grasses

BENEFITS OF BIOENGINEERING

- Minimizes further bank erosion and tree loss
- Protects threatened property
- Creates a natural appearance
- Shades streams, improving the fishery
- Increases wildlife habitat
- Reduces sediment, phosphorus, nitrogen, and other pollutants
- Reduces cost of construction

Stabilized streambanks using coir fiber matting, coir fiber roll toe protection and rock vanes

BIOENGINEERING TECHNIQUES USED AT THE BAUGHMAN'S/BEL AIRE LANE PROJECT AT ROCK CREEK PARK

LIVE STAKES / COIR FIBER MATTING

Stout live woody cuttings create root mat that reinforces and binds soil after fiber matting biodegrades.

COIR FIBER ROLL

Fiber roll protecting toe of slope near sewer line and manhole. Provides toe protection and enhances establishment of permanent vegetation.

ROCK CROSS VANE

Directs flow to center of stream, away from banks, reducing erosive pressure. Increases variety and quality of fish habitat.

IMBRICATED ROCK

Allows trapping of sediment between rocks and establishment of natural riparian plant species.

COSTS!!!

Utilizing soil bioengineering methods can improve the environment in the stream corridor at reduced costs over traditional methods—a winning combination.

ROCK CREEK PARK PROJECT COSTS PER FOOT

Bioengineering practices and supporting structural practices vary a great deal in cost, but typically cost less than conventional structural alternatives. The overall average cost of constructed practices on the Rock Creek Park project between Baughman's and Bel Aire Lane for treating 1383 feet of bank along a 1700-foot reach of stream was **$111.50/foot**. A typical treatment might involve stone or coir fiber roll toe protection, fiber matting, and live stakes, at $78 to $93/foot. Because some stream restoration work had previously been done in the immediate vicinity, design costs for this project were fairly low at less than $15/foot of stream length.

Bioengineering & Supporting Practices	Average Cost/foot
Coir fiber roll toe protection	$ 45
Stone toe protection	$ 60
Coir fiber matting protection	$ 5
Live stake installation (3-4 rows)	$ 8
Imbricated stone	$133
Rock cross vane	$2100/structure

Structural options: Gabion basket $120-$150/foot Stone rip-rap $200-$250/foot

PUBLICATIONS

For more information on stream restoration and bioengineering, refer to these publications:

- USDA NRCS Engineering Field Handbook, Chapter 16, "Streambank and Shoreline Protection".

- Stream Corridor Restoration: Principles, Processes, and Practices. October 1998. Federal Interagency Stream Restoration Working Group, Washington, DC. Downloadable at http://www.usda.gov/stream_restoration.

- Soil Bioengineering or Streambank Restoration for Riparian Forest Buffers. Maryland Cooperative Extension Fact Sheet 729. Downloadable at http://www.agnr.umd.edu/ces/pubs/topics/forwildmgmt.

- Riparian Forest Handbook1: Appreciating and Evaluating Stream Side Forests. Virginia Department of Forestry, 900 Natural Resources Drive, Suite 800, Charlottesville, VA 22903. Contact: Samuel Austin, Forest Hydrologist, (804) 977-6555.

HOW TO GET STARTED

The following organizations and agencies were involved with the Rock Creek Park project and will provide you advice and assistance to help you determine if your site is suitable for a bioengineering project and to obtain a list of experienced consultants for design and contractors for construction.

- City of Frederick Department of Public Works
  Contact: Marc Stachowski
  111 Airport Drive East
  Frederick, MD 21701-3152
  301-694-1162

- Maryland Department of Natural Resources
  Contact: Anne Hairston-Strang
  Capital Grants and Loans Administration
  Shore Erosion Control
  Tawes State Office Building
  580 Taylor Avenue E1
  Annapolis, MD 21401
  410-260-8523

- Maryland Eastern Shore Resource Conservation and Development Council, Inc.
  Contact: David H. Wilson
  8133 Elliott Road, Suite 201
  Easton, MD 21601
  410-822-9300

- Western Maryland Resource Conservation and Development Council, Inc.
  Contact: Timothy Hann
  First Flight Airpark
  18450 Showalter Road, Suite 111
  Hagerstown, MD 21742-1347
  301-733-2973

- Frederick Soil Conservation District
  92 Thomas Johnson Drive
  Suite 230
  Frederick, MD 21702-4300
  301-695-2803

- Other Local Soil Conservation District Offices
  Located under County Government
  in Phone Book

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